

Electricity Supply Industry Reform in Malaysia: Current State and Way Forward



Hazleen Aris, Bo Nørregaard Jørgensen, I S Hussain

Abstract: *The Malaysia electricity supply industry (MESI) has gone through a series of reforms and restructuring since it first started at the beginning of the last century. The latest series of reform, known as MESI 1.0 has been ongoing since 2010. The objectives are to achieve secure and reliable supply of energy, to have economically competitive tariffs, to be environmentally sustainable and to improve customer satisfaction/choice. MESI 1.0 is now coming to its end, and in a recent development, the government has announced the commencement of the next series of MESI reform, MESI 2.0. The objectives of MESI 2.0 are to increase the industry efficiency, to future proof the industry, structure, regulations and key processes, and to empower the consumers. MESI 2.0 is obviously the continuation of MESI 1.0. Thus, prior to the start of MESI 2.0, it is important to review the progress and achievements of MESI 1.0 in such a way that enables informed decisions to be made in designing MESI 2.0. This paper therefore presents a review on the progress and achievement of MESI 1.0, focusing on the initiatives undertaken and evaluating the extent to which the objectives of MESI 1.0 have been addressed by the initiatives. Analysis performed on the review results shows that the second objective of having competitive tariffs is mostly addressed by the initiatives whereas more work needs to be done to address the other objectives, particularly on being environmentally sustainable. Liberalization through the unbundling of MESI is also identified as the potential means to achieve the objectives of MESI 2.0. Findings from this study can serve as the reference point in identifying the current state of MESI reform and in determining the way forward for subsequent MESI reforms.*

Keywords: *Electricity, Regulations and Reliability*

I. INTRODUCTION

Malaysia electricity supply industry (MESI) has gone through a long journey since pre-independence and has gone through a complete private-state-public cycle [1].

From privately owned and managed, it became monopolistic after the national electricity board (NEB) gradually took over the companies that were privately generating and supplying electricity. Two years after the privatization of the NEB (where the name changed to Tenaga Nasional Berhad (TNB)), the monopoly structure started to slowly make way for other participants at the generation level with the presence of the independent power producers (IPPs). Grievances from the major stakeholders and customers had prompted a study on MESI to be conducted by Khazanah Nasional Berhad (Khazanah) in 2008, which concluded that MESI was underperforming and that this was largely due to the subsidization. An immediate consequence of the finding from the Khazanah's study was the setting up of the My Power Corporation (My Power), a special purpose agency created to detail out the key reform initiatives of MESI 1.0 that aligned with the government's economic transformation programmes (ETP) at the time.

In the recent announcement made by the Minister of Energy, Science, Technology, Environment and Climate Change (MESTECC), the Malaysia electricity supply industry (MESI) is said to undergo another series of reform, MESI 2.0. The objectives of MESI 2.0 are to increase the industry efficiency, to future proof the industry, structure, regulations and key processes, and to empower the consumers. Industry efficiency is expected to be increased through greater utilization of the market-based competition throughout the value chain, reduced government intervention, increased transparency, adoption of more cost-reflective and time-based tariff, subsidization of targeted consumers and increase in cross border trade. Future proofing the industry is to be attained through the introduction of the market-based competition, adoption of new technologies, promotion of renewable energy (RE) and the implementation of the energy efficiency initiatives. The last objective of empowering the consumers can be achieved by incentivizing their active participation as power producers. The ultimate aim of the MESI 2.0 reform is to have an efficient, transparent, sustainable, market-based (competitive) and green power industry for Malaysia. In order to achieve the stated objectives, a lot more initiatives are expected to take place. However, prior to embarking on any, an analysis on the current state and achievement of MESI 1.0 is needed in order to know the extent to which the initiatives implemented in the earlier reform (MESI 1.0) have managed to attain the stated objectives. This is important to ensure continuity, to avoid from reinventing the wheels and to learn from the lessons of the previous reform.

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This paper therefore presents the results of an analysis performed on the current state of MESI 1.0, focusing on the initiatives taken and the extent to which the initiatives have addressed the MESI 1.0 objectives. It then provides recommendations on the way forward for MESI 2.0 based on the current state and achievement.

II. MESI 1.0 REFORM INITIATIVE

The objectives of MESI 1.0 are to achieve secure and reliable supply of energy, to have economically competitive tariffs, to be environmentally sustainable and to improve customer satisfaction/choice. Based on the objectives, nine reform initiatives were planned as listed below in no particular order of importance [2].

- Gradual phasing-out of gas subsidy with stabilization mechanism
- Incentive-based electricity tariff regulation with regulatory accounts unbundling, performance incentive scheme and imbalance cost pass-through mechanism
- Competitive framework for new generation capacity development
- IPP generation efficiency savings sharing framework
- Generation fuel security policy framework
- Ring-fencing of single buyer and system operator with market rules and regulatory oversight
- Gas third party access framework
- Enhanced time-of-use (ETOU) and cost-reflective tariffs framework
- New enhanced dispatch arrangement (NEDA)

The need to implement the first initiative is obvious, as subsidization was found to be the main reason that causes MESI to underperform. All other initiatives are basically derived due to the need to address the subsidization issues. One of the first tasks of My Power was to revise the controversial power purchase agreements (PPAs) with the IPPs. This has resulted in a more transparent process of awarding contracts to the new IPPs being implemented through competitive bidding beginning 2010, and renegotiation with the existing IPPs. Competitive bidding and renegotiation should address the third and the fourth initiatives. In an effort to improve the industry structure, the managed market model (M3) proposed by the Boston Consulting Group in an earlier study was revisited and revived by My Power [1]. As a result, the single buyer (SB) and the grid system operator (GSO) departments were introduced into the MESI structure in 2012, both of which were carved out from TNB. The SB department is responsible for the least cost dispatch scheduling, managing the PPAs and the settlement process [1]. The single buyer model differs from the conventional monopoly model in that the generation sector is divided into several economically independent power generating companies [3]. They compete with one another to sell electricity to the single buyer. Since the IPPs have already co-existed with the TNB Generation at the time, transition into the single buyer model seemed to be the most straightforward and least disruptive to be implemented in MESI. However, it is also regarded as an ‘imperfect competition’ because there is only one buyer. Thus, the model is exposed to negative

consequences such as being prone to corruption, weakening payment discipline and imposing large contingent liabilities on the government [4]. To alleviate such consequences and taking into consideration that the SB department is still part of the TNB, it is being ‘ring-fenced’ as shown in Fig. 1. This in principal means separation of its account as well as its operations, although ownership wise, it still belongs to TNB. The GSO is also a ring-fenced department within TNB, which is responsible for the operational planning, real-time re-scheduling, dispatch and control of the grid system in compliance with the provisions of the grid code. The grid code is a technical specification, which defines the parameters an electricity generating plant and grid system network have to meet to ensure proper functioning of the electrical grid. The GSO is also responsible for the coordination of all parties that are connected to the grid system, which comprises systems of generation, transmission and distribution of electricity covering larger network across countries or continents. The SB and GSO departments report directly to the Energy Commission (EC). With this implementation, the sixth reform initiative above was addressed to certain extent.

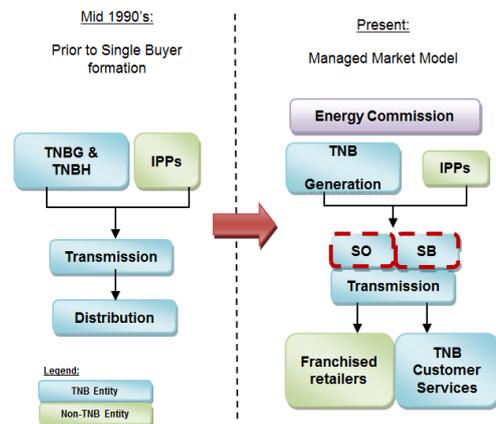


Fig. 1 MESI reform to the present model [2]

Moving on, incentive based regulation (IBR) was introduced in 2014 as part of the reform agenda, with built in incentives to improve efficiency of regulated entities and to give greater transparency for customers with respect to the electricity tariffs. Its prerequisite was the setting up of the ring-fenced SB and GSO described earlier. The IBR started with the unbundling of the accounts of the entities within TNB to establish a transparent and accountable process. The vertically structured TNB management was broken down into five entities, namely TNB Generation (TNBG), TNB Transmission (TNBT), Single Buyer (SB), Grid System Operator (GSO), and Customer Service (CS). Each entity keeps its own regulatory account, which allows the regulator to break up components in the tariff. The IBR provides a systematic way to incentivize or penalize power utilities based on a set of performance indicators. The implementation of IBR in Malaysia is driven by the following needs.

- For the consumers to have electricity prices at par with the standard and quality of service they receive,



- For the TNB to ensure a fair rate of return and
- For the government to develop a transparent economic regulation for TNB, as well as to promote efficiency.

The IBR came together with the implementation of the Imbalance Cost Past Through (ICPT), a mechanism that allows adjustments to be made in consumers' electricity bills every six months. Thus, consumers will no longer be enjoying a fixed rate for a long period of time. Under the IBR, the rate billed to the consumers is made up of two components, the base tariff and the ICPT (Fig. 2). The base tariff is made up of the CAPEX and OPEX of transmission, distribution, GSO and SB operation, return on regulated assets for transmission, distribution, GSO and SB operations, transmission and customer services, as well as the power purchase cost charged by the generators to SB [5]. The base tariff is derived based on the fuel price assumption. For example, effective 1st January 2014, the base tariff is 38.53 sen/kWh based on the fuel price assumption of US\$87.50 (RM337.3)/tone for coal, RM41.68/mmBtu for liquefied natural gas (LNG) and RM15.20/mmBtu for domestic gas. The adjustment is made from the base tariff with respect to the uncontrollable cost (changes in prices of fuel for electricity generation, costs associated with PPAs & service level agreements (SLAs) and RE displaced costs). The adjustments produce varying rates of a rebate or surcharge to reflect the cost. Thus, movements in the prices of imported gas and coal prices, as well as domestic gas in the previous six months, will be reflected as a rebate or surcharge in the following six months, subject to government approval.

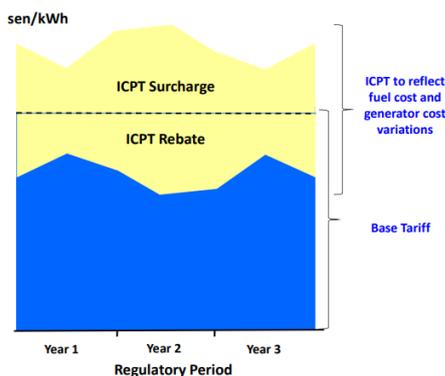


Fig. 2 Base tariff and ICPT in the IBR framework [5]

The implementation of ICPT was put under what is called the regulatory period from January 2015 to December 2017 (RP1). Although the base tariff is fixed for the regulatory period of three years, the actual rates paid by the consumers will vary under this mechanism. The rebate is therefore not in any way permanent. Should a surcharge kick in to compensate for changes in the fuel cost, this too would be adjusted in the next review. Seven cycles of ICPT for RP1 were announced from the period of March 2015 to December 2017 involving rebates. Rebates of 2.25 sen/kWh was announced in 2015, and 1.52 sen/kWh in 2016 and 2017. The next regulatory period (RP2) has started and will cover the next three year period from January 2018 to December 2020. The determined base tariff for RP2 is 39.45 sen/kWh [6]. The first cycle six-month cycle from January to June 2018 involves rebate of 1.52 sen/kWh while for the second cycle from July to December 2018, a

surcharge of 1.35 sen/kWh is imposed. Currently, the electricity charges billed to the customers are still in the form of a 'bundled tariff' comprising sum of transmission, system operator, single buyer and customer service tariff. In the future, the bill will be made more transparent and efficient with the cost elements from the separate entities shown.

In July 2015, the Electricity Supply (Amendment) Act 2015 (Act A1501), which is an upgrade of the Electricity Supply Act (ESA) 1990, was passed by the Parliament. The amended act allows the functions of the SB and the GSO to be separated from the TNB. This means creating a demarcation to separate the activities, assets, costs, revenues, service obligations and functions of the SB and GSO from those of licensees (such as Independent Power Producers or IPPs) to ensure independence and enhance transparency and competition. This is another step ahead for SB and GSO en route to becoming independent single buyer (ISB) and independent grid system operator (IGSO) as originally planned. To further streamline the role of the SB entity, the new enhanced dispatch arrangement (NEDA) rules were launched in October 2015. NEDA is meant to be an avenue that enhances competition and cost efficiency of the single buyer market. It incentivises the power generators to be more efficient. With NEDA, the generators that have signed the PPAs are allowed to compete based on their variable operating rates (VOR), rather than the fixed rate in the PPAs or SLAs. As a result, the generators can decide if they want to bid for a VOR that is lower than their PPAs/SLAs, in exchange for more dispatch (generation supply). Hence, power plants that are better managed and more efficient will be able to make more money at the expense of their less competitive peers. This however will not affect the capacity payment. Beginning the first quarter of 2016, non-PPA generators are also allowed to compete in the new system of competitive daily bidding for electricity prices. By opening up electricity supply to power generators with existing and expired agreements, NEDA will help to push down the cost of electricity in the country. It therefore addresses the last reform initiative on the list.

On the 4th of November 2015, the EC invited representatives from the industry to its headquarters in Putrajaya for a briefing on the introduction of the enhanced time of use (ETOU) tariff and amendments to the special industrial tariff (SIT). Time of Use (TOU) tariff aims to encourage efficient energy usage as well as mitigate against increasing electricity bills to the customers. TOU is established primarily for the demand side management to encourage mid peak and off peak consumption and to discourage peak consumption. TOU encourages customers to use energy in an efficient manner by using less energy during peak hours or by shifting the activity out of the peak hours. With the TOU, customers are able to control their bills through own consumption, by shifting usage of electricity to time of the day when rates are cheaper, hence reducing the monthly bills. It also encourages energy efficiency practices among customers.

With the enhanced TOU, a number of improvements are made, including the introduction of the three time zones (peak, off peak and mid peak) instead of two (peak and off peak) in the existing TOU. The previously 14 hours of peak time zone is now divided into 4 hours of peak time zone and 10 hours of mid

peak time zone effective 1st January 2016. This reflects more savings on the customers' side. The ETOU tariff is also offered to the industrial low voltage (LV) customers. The SIT has been implemented since 1996. As of end of 2015, the total SIT discount was estimated at RM 6,185.4 million. However, the SIT discount was gradually reduced by 2% every year beginning 1st January 2016 until 2020 [7].

With regard to fuel security, a number of policies have been developed to ensure its prolonged and efficient use. Electricity generation in Malaysia largely relies on fossil fuels, which are costly. Currently, coal and gas constitute 40% and 55% respectively of the total generation mix in Peninsular Malaysia while the rest is from hydro. Although there is a lot of hydro potential in Sabah and Sarawak, land cleared for dams is not the long-term solution to meet the nation's power needs. Thus, the later policies concerning the fuel security are seen focusing on the renewable with the latest being the National Renewable Energy Policy and Action Plan 2010. In 2001, the Five Fuel Policy was enacted as part of the 8th and subsequently 9th Malaysia Plan, which adds RE sources to the national mix. With this, the government has identified RE as the nation's fifth fuel after oil, gas, coal and hydro. Subsequently, a plan has been drafted whereby RE should account for 5% share of the energy mix by 2005, which was retained for 2010 due to the failure to achieve the set target. However, only 0.3% and 8.3% of the targets were achieved at the end of 2005 and 2010 respectively [8]. As at 2012, 11 years after the introduction of the Five Fuel Policy, there are only 41.5 MW planted up using landfill gas and empty fruit bunch from the palm oil industry. In a survey done involving RE developers, palm oil millers, RE project funders, relevant government agencies and IPPs, the following were found to be the reasons for the slow acceptance of RE generation in Malaysia [9].

1. The government was not keen to subsidise RE generations and leave it to the private sector to be the prime movers
2. The monopolistic government linked utility company themselves are not keen as the capacity of RE generations tends to be small (less than 10 MW) and the margin is small
3. Feedstock owners themselves are not keen as alternative usage gives better yield

Other barriers to the implementation of the five fuel policy in Malaysia are found to be the lack of agreement and knowledge as well as barriers from the perspectives of technology, economic, social and political [8]. Despite the slow progress and the missed targets, Malaysia is far from giving up on RE. In fact, the target was optimistically increased to 5.5% (985MW) by 2015 and by 2020; the target

is for the RE to comprise 11% or 2,080MW of the overall electricity generation in the country. The set targets come together with the supporting initiatives to realise them, such as the formation of a regulatory body called the Sustainable Energy Development Authority (SEDA) as a result of the introduction of the Renewable Energy Act 2011 to oversee, inter alia, the implementation of the feed in tariff (FiT) scheme. The FiT scheme enables companies and house owners to produce RE and sell it to the grid. The four RE resources that are eligible for FiT are biogas, biomass, small hydropower and solar photovoltaic (PV). TNB and SESB (the FiT scheme has yet to cover Sarawak) are obligated under the Renewable Energy Act 2011 to accept the power into the grid. As a result, despite underachieving, improvement can be seen where in 2014, RE accounts for up to 243 MW of installed capacity that mostly come from solar energy [10].

Finally, the reform initiatives are not only limited to matters that are directly related to the electricity, but also the resources used to generate it. Similar competition is also envisaged for the gas market in Malaysia. One way to achieve this is through the implementation of the third party access (TPA) system that enables the third parties to access gas facilities that they do not own or operate. In pursuance to this matter, the Gas Supply (Amendment) Bill 2016, which is an act that amends the Gas Supply Act (GSA) 1993, was passed in the Parliament on 14 June 2016 and came into effect on 16 January 2017 to provide the legal framework for the TPA system? It aims to ensure gas security in Malaysia by liberalizing the sector and allowing the third party operators to import, regasify, transport, distribute, ship, retail via licensee pipe and use natural gas. There are three main objectives of the amended act which are to allow third parties to access gas infrastructure for the supply of gas to consumers, to promote healthy competition in the gas supply industry, and to enable gas consumers to benefit from the competitive prices, better services and enhance sustainability. Currently, there are three types of gas facilities that fall under the scope of the TPA system, namely the regasification terminals, transmission pipelines and distribution pipelines. With the TPA system in place, it is envisaged that there will be healthy competition among the players, thus ensuring reliable and sustainable gas supply to the consumers.

III. ANALYSIS AND DISCUSSION

With the nine reform initiatives as the basis and the four MESI 1.0 objectives to be achieved, numerous changes have been taking place in MESI for the past ten years. These changes are affecting its market structure, governance, the electricity tariff and fuel security. Based on the elaboration of the initiatives above, the objectives that are directly addressed by the implementation of each reform initiative are summarised in Table 1. From the table, it can be seen that some initiatives are intertwined where one initiative that primarily impacts one objective may secondarily impact the other objective.

Table. 1 MESI reform initiatives versus objective

Reform initiative	Objective			
	Secure and reliable supply of energy	Economically competitive tariffs	Environmentally sustainable	Customer satisfaction /choice
Gradual phasing-out of gas subsidy with stabilisation mechanism		✓		✓
Incentive-based electricity tariff regulation with regulatory accounts unbundling, performance incentive scheme and imbalance cost pass-through mechanism		✓		✓
Competitive framework for new generation capacity development		✓		
IPP generation efficiency savings sharing framework	✓			
Generation fuel security policy framework	✓		✓	
Ring-fencing of single buyer and system operator with market rules and regulatory oversight		✓		
Gas third party access framework	✓			
Enhanced time-of-use (ETOU) and cost-reflective tariffs framework		✓		✓
New enhanced dispatch arrangement (NEDA)		✓		

From the table, it can be seen that the objectives of MESI 1.0 are not evenly addressed by the nine reform initiatives. Most of the initiatives, i.e. six out of nine, are concentrating on providing economically competitive tariffs to the consumers, which, in some initiatives, are also tied to attaining customer satisfaction or choice. Secure and reliable supply of energy and customer satisfaction/choice objectives are equally addressed by three initiatives each. The table also shows that the environmentally sustainable objective is being least addressed with only one initiative that is having direct impact on the objective. This could perhaps explain the poor performance with regard to the production and use of RE. Thus, it is something that needs to be given appropriate attention in designing the next reform series such that the set targets can be achieved.

It can also be seen that despite the numerous reform initiatives, the main aim of the reform to reduce dependency on the subsidies, in our opinion, has not seen much improvement. Gas is still being sold below the market price and PETRONAS is going to continue to lose the opportunity cost for having to sell the gas at the predetermined price to IPPs instead of the prevailing market price. Electricity price tariff is still very much fixed, especially for the domestic consumers. Furthermore, the electricity price tariff is regarded as a sensitive issue that concerns a lot of people. Any changes in the tariff, especially involving increment, have to be carefully dealt with, elaborately justified, approved and hence, backed by the government to avoid

public uproar. Thus, it can be seen that the government is still very much in control of the MESI. For example, it has even been announced that the tariff is not going to be changed until December 2020, which implies more costs being absorbed by the government [11]. Therefore, it is still a long journey for MESI to detach the subsidies from the government. Nevertheless, in our opinion, liberalisation of MESI through unbundling is still the way forward for MESI to attain the reform objectives, despite the challenges and slow progress. In this regard, Malaysia can perhaps look and learn from the countries that have successfully attained efficiency through electricity market liberalisation and unbundling, such as the Nordic countries, which are regarded as performing better than the US [12]. What Malaysia needs to do is to localise the solutions to suit its constraints and needs. To support our proposition, in the subsequent paragraphs, we will briefly discuss on how the three objectives of MESI 2.0 can be attained through unbundling.

IV. IMPROVING EFFICIENCY

Attaining efficiency has always been at the forefront of the electricity industry reform agenda in many countries. It is,



however, an elusive target due to the many parameters involved and different methods used in measuring efficiency. MESI reform has also thus far been focusing on improving the efficiency in terms of the governance, industry structure, fuel supply and security, and tariff. In MESI 2.0, additional measures to improve efficiency are seen such as extending the market-based competition throughout the value chain and increasing the cross border trade. At the moment, competition, if any, is only present at the generation (upstream) level. MESI is currently adopting the single buyer market model where the power producers are selling the generated electricity to the single buyer with little competition amongst them. In fact, with the signed PPAs, competition is perhaps almost non-existent. Each power producer will get the chance to 'sell' their generated electricity at the price agreed in their respective PPAs. In MESI 2.0, the competition is expected to be made more extensive with the presence of more industry players (retailers) to bid and purchase electricity from the power producers. Thus, the single buyer model will be changed to a more competitive wholesale electricity market model. With this too, competition is going to be extended beyond the generation level along the value chain. Retailers who purchase the electricity from the power producers in the wholesale market will be selling it to the end users, i.e. consumers, who should be allowed to choose their preferred retailers, thus creating competition at the retail level, i.e. the retail market. With such unbundling, MESI will move a few steps closer towards the liberalisation of its electricity supply industry.

With regard to the cross border trade, having a competitive electricity market with many buyers and sellers, including those from the neighboring countries, is another option that can help to propel towards efficiency, and unbundling is the prerequisite to such competitive market [13]. The power exchange market is made possible after the extensive unbundling of the electricity supply industry with many sellers (producers) and many buyers (transmission system operators, distributors and retailers/suppliers) joining the market. Malaysia can start small with regard to such market, just like the Nord Pool that started initially with Norway, and later joined by Sweden and other countries. At the moment, transmission grid that connects Malaysia with its neighboring countries is already in place and Malaysia is already selling electricity to Indonesia and buying from Laos and Singapore. Through the market and the grid, surplus capacity can be exported to other countries and vice versa, hence keeping energy waste in the region to the minimum.

V. FUTURE PROOFING STRUCTURE, REGULATIONS AND KEY PROCESSES

Future proofing the industry essentially means ensuring the sustainability of the industry. In this regard, improving the efficiency should also be considered from the perspective of the effective use of resources, in view of the depleting fossil fuels and the limited opportunity for RE in Malaysia, that is, how much of the produced electricity is actually consumed and how much goes to waste. The current electricity reserve margin, which stands on average

at more than 40%, especially in Sabah and Sarawak, needs to be reviewed and possibly reduced. Peninsular Malaysia used to have surplus capacity peaked at all time high of 56% in 2003, 53% in 2009 and between 31% and 45% in the period from 2001 to 2013, 'thanks' to the PPAs signed with the IPPs that is making the TNB obliged to purchase the generated electricity by the IPPs in any case of the reserve margin. Although the comfortable margins can guarantee uninterrupted electricity supply to the consumers, i.e. reliability, the unused energy will still be wasted. Not to mention that the generating cost of this unused power will somehow be transferred to the consumers. However, with the reform initiative that imposed competitive bidding for new IPPs commencing 2010 and renegotiation with existing IPPs, the reserve margin can be seen reduced to 25% in 2014 but increased slightly to 26% in 2015. In a more drastic move recently, four IPPs have been discontinued [14] while four others are being put under review, an act that is said to be able to save RM1.26 billion in electricity tariffs [15].

Statistical information on RE presented earlier also shows that MESI performance with respect to the energy produced from the renewable sources is below the set target. Energy production is still heavily dependent on oil and under the four-fuel policy that aims to diversify electricity sources; gas power generation has been rapidly expanded. In recent years, coal has replaced gas as the largest electricity source and this does not improve the RE situation in any way. In fact, it leaves a major future challenge on the electricity generation mix that Malaysia should choose to meet the growing electricity demand while at the same time considering the environmental load, energy security and economic efficiency. At the current production rate, reserve-to-production ratios of the oil and gas are showing the signs of depletion. Oil is expected to last for another 30 years, while gas may hold for about 40 years more. Malaysia therefore needs to restructure its electricity generation mix to cater for the aforementioned challenges of climate change and diminishing fossil fuels. Amongst the options that Malaysia has is to consider nuclear power generation. In fact, the government has laid plans to commission a 2.0 GW nuclear power plant scheduled to be in operation by 2030. However, the Fukushima Daiichi nuclear disaster in 2011 had increased the awareness and concerns of the Malaysians on the inherent risks of a nuclear power plant and implementing the plans is expected to be not easy. Thus there is a need to explore other long term sustainable options for power generation in Malaysia that are also safe.

This has left Malaysia with only one option, the RE, which, as described above, is showing an extremely slow progress despite the enactment of the five fuel diversification policy. Therefore, the RE power generation needs to be expanded with the necessary costs, grid and structure modifications, and other measures taken into account. Another reason that strongly supports the move towards RE is the need to reduce the carbon dioxide (CO₂)

emission. At present, Malaysia is one of the largest carbon dioxide (CO₂) emitters in South East Asia and ranked third after Indonesia and Thailand. A total of 54.8% of the CO₂ emissions in Malaysia comes from the power sector alone [16]. In accordance with the Paris agreement that Malaysia has ratified, 45% of the greenhouse gas (GHG) emissions need to be reduced relative to the 2005 levels by 2030, in which 35% reduction is on unconditional terms and 10% is upon the receipt of climate finance, technology transfer and capacity building from advanced countries. This translates into the mission to curtail 42.2 million tones of CO₂ emissions through RE generation. Thus, RE may no longer be an option for Malaysia, but a must.

VI. EMPOWERING CONSUMERS

MESI 2.0 also aims to empower the consumers. Empowering the customer means giving them more control and flexibility to decide what work best for them with regard to their electricity consumption. This means that the consumers will have the power, to a greater extent, in determining how much their electricity bill will be. One way to do this is by having different electricity tariffs at different times of the day, peak and off peak. In MESI thus far, such option is only available for the industrial and commercial customers through the ETOU scheme. For domestic consumers, the rate is fixed regardless of the time of the day. Savings are only possible by controlling the amount of electricity used, because tiered tariff is applied. In the Nordic countries, variable price is not new and in fact, price is updated on monthly basis, with hourly basis in Finland, depending on the actual cost of producing and transmitting the electricity. Monthly variation in the electricity price carries the benefit of enabling the consumer to respond to the price signals by adjusting the consumption to price level, or consuming electricity at times when the price is low. This way, they will be indirectly incentivized with lower electricity bill.

Another means of empowering the consumers is by enabling them to choose their electricity suppliers. Though this is not currently practiced in MESI, the option has been considered for quite some time. MESI is expected to undergo more reform initiatives to achieve the envisioned structure shown in Fig. 3, by the year 2020. This means that, as mentioned earlier, unbundling is going to take place more extensively at the lower level (downstream), creating the retail market. MESI will see the inclusion of more retail companies into the structure that provide electricity supply to the contestable consumers. These are the consumers who are allowed to choose to purchase electricity from the licensed retailers, or from the main utility companies, depending on which offers that best suit their consumption patterns [17]. Competitive electricity retail markets help to inculcate awareness as the consumers would become more sensitive to the changes in the industry and know that altering their electricity usage accordingly will ensure that they can adapt optimally to the on-going changes.

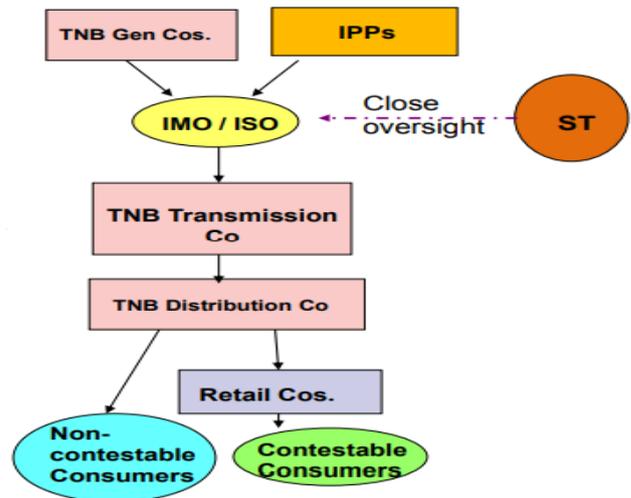


Fig. 3 Envisaged future model for MESI [2]

Finally, consumer empowerment can also be attained by encouraging them to generate (renewable) energy and to become prosumers. In a very recent study done, technically, solar PV rooftop potential in Peninsular Malaysia alone is 34,194 MW [18] and this can definitely help in increasing the share of RE production in Malaysia. To a certain extent, this can be facilitated by having the open electricity market through unbundling as discussed earlier. In the Nordic countries for example, this has become a common practice where excess in the electricity produced by the consumers can be sold to the retailer and fed to the grid. The net energy metering (NEM) introduced in January 2019 [19], which allows excess electricity generated from the solar PV to be exported back to the grid on a one-on-one offset basis is a great move towards increasing the RE share in the electricity generation mix and will hopefully provide the just the encouragement that the consumers need.

VII. CONCLUSION

In this paper, review on the initiatives, objectives and achievements of the current MESI reform (MESI 1.0) is presented. The review is timely, considering the recent development involving MESI where the newly appointed minister of MESTECC announced the next cycle of reform initiatives, the MESI 2.0, in September 2018. Findings from the review show that the objectives of MESI 1.0 were unevenly addressed with the least number of initiatives to address environmental sustainability. This paper also proposes that the objectives of the subsequent MESI reform, MESI 2.0, which are to improve industry efficiency, to future proof the industry and to empower the consumers be achieved through unbundling and the creation of wholesale and retail electricity markets. However, a clearly laid out plan needs to be prepared to enable a smooth transition. Nordic countries achievement with regard to the electricity market efficiency as a result of unbundling would be a good starting point for this purpose.

Thus, in future work, unbundled electricity supply industry in the Nordic countries will be explored in greater detail in such a way that lessons learnt from it can be used to chart the path for MESI transition towards greater efficiency through market liberalisation and unbundling.

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